doi.org/10.54473/IJTRET.2022.6502
International Journal of Trendy Research in Engineering and Technology
Volume 6 Issue 4 August 2022
ISSN NO 2582-0958

A NEW APPROACH TO A PORTABLE ATTENDANCE MARKING SYSTEM USING PIC16F877A

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Received 14 May 2022 Received in revised form 20 May 2025 Accepted 21 May 2022
Available online 03 June 2022

ABSTRACT

Marking the attendance of the students is very important in universities, colleges, and institutions. The main objective of this work is to make a portable attendance system. We have used RFID technology for this system. The main aim of our system is to get the attendance without wasting time, without any paperwork, and also to get the attendance details quickly. This system has a microcontroller and that is the heart of the system. After we entered the information about the student's ID, the system will save it automatically, and then the system can work on its own.

Keywords: RFID, PIC16F877A, Attendance

1. Introduction

There are many universities, colleges, and institutions in the world, and thousands of students study in these education centers. So getting attendance is very important since is one way of assessing the efficiency of the lecturer who handles the particular subject. It is also very useful to get the attendance without using papers and without wasting the time. When taking the attendance of the students, it is also important to note down the time and date Hence an automated attendance system is more valuable to lectures and the teachers and the other ones who get the attendance of the students.

That's why we need the portable automated attendance system. A manual attendance-taking system is in practice in most institutions. Manual attendance taking and reporting is easy if there are below 50 students and for a larger number of students, it is very difficult and it consumes more time. The present digital portable attendance marking system is a better way to solve this issue. Each and every lecturer or teacher can use this system when they are going to the lecture hall. This automated marking system is easy to use and can easily identify valid and invalid ID cards and can save the information of the ID cards.

2. Literature review

Because of the difficulty of getting the attendance manually, the automated marking systems had been coming to the usage. There are several technologies to get attendance and there are numerous reports available[1-5]. Mainly there are two attendance systems in the world. They are the RFID system and the Biometric system[6-9]

2.1 RFID system

RFID (radio-frequency identification) technology uses radio waves and using the radio waves it can transfer data to an RFID tag or a label using an electronic tag. So there are 2 main parts and they are the RFID tag and the label. Also, RFID technology is a ripe technology. Today there are many organizations that use this technology for their automation systems. In our project, the RFID system produces the attendance of the students and the tome of the attendance. The RFID reader can read the ID card number and can save

the ID card number, and record the attendance and time of the attendance.

Fig. 1. RFID card

2.2 Biometric system

A Biometric system uses someone's behavioral and biological characteristics to identify someone. The biological characteristics are hand geometry, fingerprints, face geometry, voice, etc. Signature recognition is also a behavioral characteristic. Using those physical properties of the body parts can get the attendance easily. Also, this is the safest identification method. Also, this system is easy to maintain. But these biometric systems are contact attendance marking systems. In the covid pandemic scenario, people prefer contactless attendance systems.

Fig. 2 Biometric sensor

3. Methodology

Getting the attendance of the student's manual is a very hard thing to do in the classroom or the lecture room. So our main target is to make an attendance marking system to get the attendance without wasting time and to get attendance quickly. We have developed the attendance system using PIC microcontrollers, RFID tags, RFID readers, Arduino Uno board, SD card modules, and Arduino program code to run the program on the Arduino board. The details of various components and their functions for this project are explained in the following section.

3.1 Components

Mainly we used 6 components to make this automated portable attendance marking system. They are;
[1] PIC microcontroller
[2] RFID reader
[3] Arduino board
[4] RTC module
[5] SD card module
[6] 2*16 LCD

3.2 PIC microcontroller

A portable system must have a way to process the information. So we have used a Microcontroller to make an attendance marking system. There are 4 types of microcontrollers and they are PIC, AVR, 8051, and ARM. First of all, used PIC16f877a and it has 40 pins and it is a mid-range microcontroller.

Fig. 3. PIC16f877A

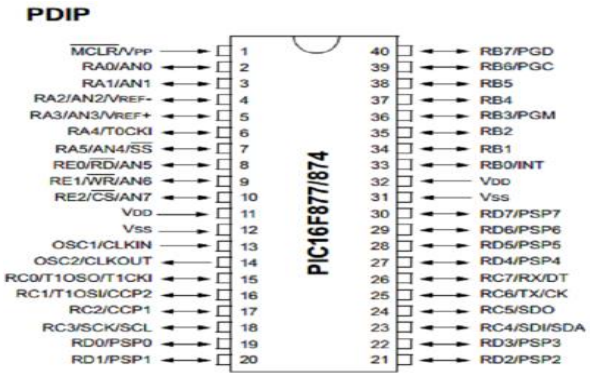

Fig. 4. Pin Diagram of PIC16f877A

International Journal of Trendy Research in Engineering and Technology
Volume 6 Issue 4 August 2022
ISSN NO 2582-0958

But PIC16f877a can't control the SD card module. Hence, we have to use another microcontroller PIC18f4550.

Fig. 5. PIC18F4550

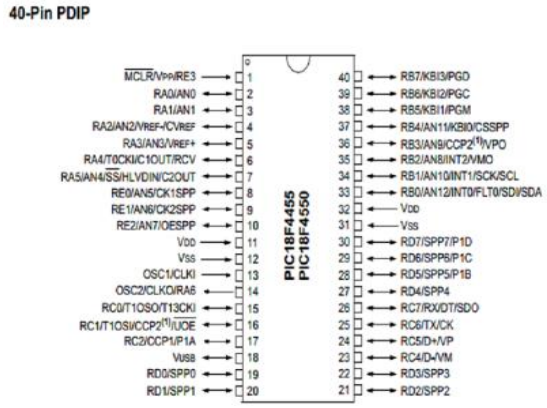

Fig. 6. Pin Diagram of PIC18f4550

The differences between PIC16f877a and PIC18f4550 are shown in the below chart.

Table.1. Differences between PIC16F877A and PIC18F4550 [10]

	PIC 18f4550	PIC 16f877a
Program memory	FLASH	FLASH
Program Memory	32 KB Flash	14KB or 8K 14-bit Flash
RAM Bytes	2058	368
Data EEPROM	256 bytes	256 bytes
Capture/compare/ PWM peripherals	1 CCP, IECCP	2x CCP
Timers	1 x 8-bit, 3 x 16-bit	2 x 8 bit, 1 x 16-bit
ADC	13 Ch, 10 bit	8Ch. 10 bit
comparators	2	2
Digital communication peripherals	1-EUSART, 1-MSSP(SPI/I2C)	1-EUSART, 1-MSSP(SPI/I2C)
Pin count	40-pin PDIP	40-pin PDIP
I/O pin	35	33

3.3 RFID reader

The RFID reader is used to reading the ID cards. The RFID tag can store information about the student's ID cards. There are 2 types of RFID tags: the active tag and the passive tag. The main difference between these 2 is the frequency. Active tag frequency is better than passive tag frequency. The passive RFID tag has a 125 kHz - 134 kHz frequency. We used the RDM6300 RFID in our attendance system. Some features of RDM6300 are;

a) Less than 100ms decoding time.
b) Maximum effective distance is up to 50mm.
c) Support external antenna.
d) Small outline design.
e) Support EM4100 compatible read-only read/ write tags

RDM6300 can be interfaced with the PIC microcontroller easily. That is the reason to select RDM6300 for this attendance marking system.

Fig.7. RFID reader

3.4 Arduino board

There are several types of Arduino boards such as Arduino Uno, Arduino Due, Arduino mega, and the Arduino Leonardo.
For our attendance system, the Arduino Uno is used. Arduino Uno has a 16MHz processor with the microcontroller ATmega 328. Also has 2kB SRAM memory with 6 inputs[11]. The PIC microcontroller and the Arduino board are connected via serial

communication. SD card is connected to Arduino using SPI

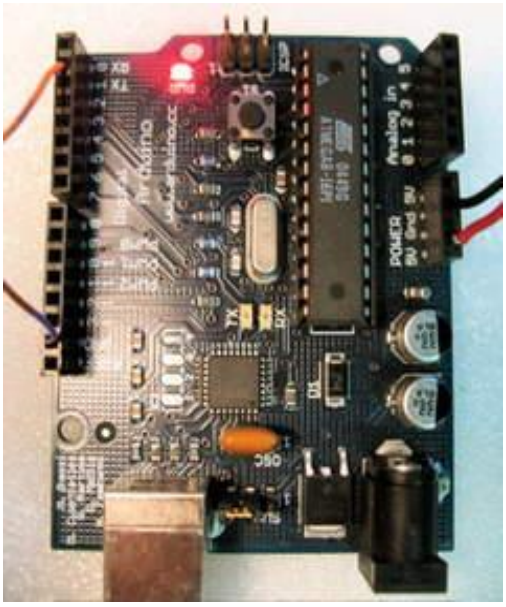

Fig. 8. Arduino board

3.5 RTC module

In the present portable attendance marking system keeping the battery for a long time is the main issue. The use of the PIC microcontroller, Arduino, and RTC module can keep the time track. RTC module has a lithium coin cell and the attendance marking system work even if there is no power supply to the system because the RTC module has its own power hence we have used the RTC DS1307 module.

Fig.9 . RTC module

3.6 SD card module

Saving the data about the students is very important to the portable attendance marking system. SD card helps to save the data about the students. The Arduino and SD card are connected to each other. Using SPI the SD card and the Arduino board can communicate.

Figure 10. SD card module

*3.7 2*16 LCD*

LCD is used to display the information which is the RFID tag read. We have used a 2*16 LCD to PIC microcontroller using serial communication. The features of the LCD are the sharpness, brightness, screen shape, etc.

*Fig. 11. 2*16 LCD*

4. Block Diagram of the System

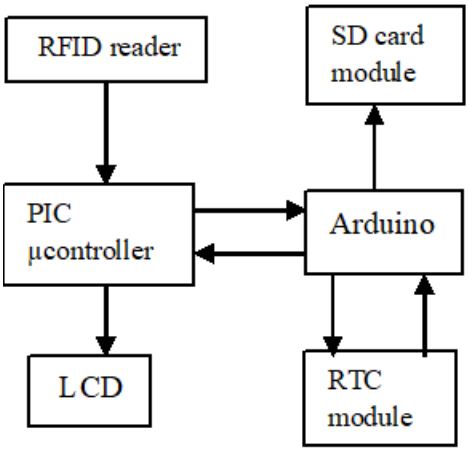

Fig.12 Block diagram of the attendance marking system

5. Construction and working of the system.

The first step is the TX pin of the RFID module was connected to the RX pin of the microcontroller and using the serial communication 4-bit mode, the LCD was then connected to the PIC microcontroller. The LCD display is connected to the microcontroller using the ID register of the microcontroller and uploading all the programming parts using the PICkit2 to the PIC microcontroller. The RFID and the LCD are then connected to the PIC microcontroller.
Used an external crystal oscillator -8Hz since the internal oscillator of the PIC microcontroller was not used. Using this the LCD and the RFID module communicate between the PIC microcontrollers. The PIC and the Arduino communicate using serial communication. After reading the student ID card information the RFID reader sends it to the Arduino using the serial communication. After receiving the information the LCD will display on the serial monitor.

The RTC module and the SD card module are connected to the Arduino since the Arduino has libraries and the SD card module is connected to the Arduino pins 8 to 13. The SD card module has 6 pins and they are VCC, VDD, CS (chip select), SCK (serial clock), MOSI (master out slave in), and MISO (master in slave out). The RTC module has 4 pins. They are VCC, VDD, SDA (data line), and the SCL (clock line). After finishing the connections of all the pins of the attendance marking system, the data will be sent to the PIC microcontroller which in turn sends the data to Arduino. Arduino received the data is then saved on an SD card. After reading the data, the RFID reader sends it to the PIC microcontroller and then to Arduino. If the number is an already saved one, then the PIC will send the information to the LCD and the LCD will display the ID card number and the name. Also, the tag number will be serially sent to the Arduino.

Fig.13. An experimental set of the attendance marking system

If the tag number is not a previously saved number, the PIC microcontroller will send a message to the LCD to display **SWIPE AGAIN** to the person.

6. Arduino program code

```
#include <Wire.h>

#include <Time.h>

#include <DS1307RTC.h>

#include <SD.h>

#include <SPI.h>

File myfile;

//mkdir("EC120");

int count = 0;

char load [15];

char temp [15];

void setup()

{

Serial.begin (9600);

pinMode (8, OUTPUT);

if (!SD.begin (10))

{

Serial.println ("failed");


digitalWrite (8, HIGH);
delay (2000);

return;


}

}

void loop()

{

tmElements_t tm;

if(Serial. available())

{

count = 0;   // Reset count to zero// Keep reading
Byte
by Byte from the Buffer till the Buffer is empty

while (Serial. available ()&& count<14)

{

//char input = Serial. read ();

//Serial. print (input);

load [count]=Serial. read ();

count++; //

delay(5); //

}

if (load[0]==temp[0] && load[1]==temp[1] &&
load[2]==temp[2] && load[3]==temp[3] &&
load[4]==temp[4] && load[5]==temp[5] &&
load[6]==temp[6] && load[7]==temp[7] &&
 load[8]==temp[8] && load[9]==temp[9] &&
 load[10]==temp[10] && load[11]==temp[11])

{

digitalWrite (8, HIGH);

}

else

{

Serial.println(load);

myfile = SD.open("text.txt", FILE_WRITE);
if (myfile)

{
```

```
myfile.println(load);
myfile.print(" :");
myfile.print(tm.Hour);
myfile.write(':');
myfile.print (tm. Minute);
myfile.write(':');
myfile.print(tm.Second);
myfile.print(", Date (D/M/Y) = ");
myfile.print(tm.Day);
myfile.write('/');
myfile.print(tm.Month);
myfile.write('/');
myfile.print(tmYearToCalendar(tm.Year));
myfile.println();
myfile.println("done");
myfile.close ();
Serial.println ("Ok, Time = ");
Serial.print(tm.Hour);
Serial.write(':');
Serial.print(tm.Minute);
Serial.write(':');
Serial.print(tm.Second);
Serial.print(", Date (D/M/Y) = ");
Serial.print(tm.Day);
Serial.write('/');
Serial.print(tm.Month);
Serial.write('/');
Serial.print(tmYearToCalendar(tm.Year));

Serial.println ();
}
int y=0;
for (y=0;y<12;)
{
temp[y]=load[y];
y++;
}
Serial.println(temp);
      }
   }
}
```

6.1 PIC MIKRO C program code

```
sbit LCD_RS at RD2_bit;
sbit LCD_EN at RD3_bit;
sbit LCD_D4 at RD4_bit;
sbit LCD_D5 at RD5_bit;
sbit LCD_D6 at RD6_bit;
sbit LCD_D7 at RD7_bit;
sbit LCD_RS_Direction at TRISD2_bit;
sbit LCD_EN_Direction at TRISD3_bit;
sbit LCD_D4_Direction at TRISD4_bit;
```

```
sbit LCD_D5_Direction at TRISD5_bit;

sbit LCD_D6_Direction at TRISD6_bit;

sbit LCD_D7_Direction at TRISD7_bit;

// End LCD module connections

void main()

{

char i,x,j,c, rfid[16],new[14];

char ash[]= "7B003C99BC62";

char sac[]= "7A007B35D0E4";

char rsh[]= "7B0039F750E5";

char sny[]= "7A007AEFA748


char mnk[]= "7A007B304776";

char v=1;

Lcd_Init();          // Initialize LCD

Lcd_Cmd(_LCD_CLEAR);          // Clear display

Lcd_Cmd(_LCD_CURSOR_OFF);  // Cursor off

//Lcd_Out(1,1,"RFID Tag Reader");   // Write text in
first row

UART1_Init(9600);       // Initialize UART, 9600
baud rate

Delay_ms(100);

lcd_cmd(_LCD_CLEAR);

lcd_cmd(_LCD_CURSOR_OFF);

lcd_out(1,1,"Swipe ID card");

while(1 ) // Infinite Loop

{

home:if(UART1_Data_Ready())       // If UART Data
Ready

{

for(i=0;i<14;)      // To Read 12 characters

{

if(UART1_Data_Ready())

{

rfid[i] = UART1_Read();

i++;

}

}

if(rfid[1]==ash[0] && rfid[2]==ash[1] &&
 rfid[3]==ash[2] && rfid[4]==ash[3] &&
 rfid[5]==ash[4] && rfid[6]==ash[5] &&
rfid[7]==ash[6] && rfid[8]==ash[7] &&
rfid[9]==ash[8] && rfid[10]==ash[9] &&
 rfid[11]==ash[10] && rfid[12]==ash[11])

{

lcd_cmd(_LCD_CLEAR);

lcd_cmd(_LCD_CURSOR_OFF);

lcd_out(1,1,"A.M.ASHVINDH");

lcd_out(2,1,"EN16532816");

for(c=0;c<13;)

{

UART1_write(ash[c]);

c++;

}
Delay_ms(2000);

asm {reset}
```

```
}

else if(rfid[1]==sac[0] && rfid[2]==sac[1] &&
rfid[3]==sac[2] && rfid[4]==sac[3] &&
 rfid[5]==sac[4] && rfid[6]==sac[5] &&
 rfid[7]==sac[6] && rfid[8]==sac[7] &&
rfid[9]==sac[8] && rfid[10]==sac[9] &&
 rfid[11]==sac[10] && rfid[12]==sac[11])

{

lcd_cmd(_LCD_CLEAR);

lcd_cmd(_LCD_CURSOR_OFF);

lcd_out(1,1,"DEVINDAN.S.J");

lcd_out(2,1,"EN16519596");

for(c=0;c<13;)

{

UART1_write(sac[c]);

c++;

}

Delay_ms(2000);

asm {reset}

}

else if(rfid[1]==rsh[0] && rfid[2]==rsh[1] &&
 rfid[3]==rsh[2] && rfid[4]==rsh[3] &&
rfid[5]==rsh[4] && rfid[6]==rsh[5] &&
 rfid[7]==rsh[6] && rfid[8]==rsh[7] &&
rfid[9]==rsh[8] && rfid[10]==rsh[9]
&& rfid[11]==rsh[10] && rfid[12]==rsh[11])

{

lcd_cmd(_LCD_CLEAR);

lcd_cmd(_LCD_CURSOR_OFF);
lcd_out(1,1,"NEELAWATHURA.R.W");

lcd_out(2,1,"EN16104754");

for(c=0;c<13;)

{

UART1_write(rsh[c]);

c++;

}
Delay_ms(2000);

asm {reset}

}

else if(rfid[1]==sny[0] && rfid[2]==sny[1] &&
rfid[3]==sny[2] && rfid[4]==sny[3] &&
 rfid[5]==sny[4] && rfid[6]==sny[5] &&
 rfid[7]==sny[6] && rfid[8]==sny[7] &&
rfid[9]==sny[8] && rfid[10]==sny[9] &&
 rfid[11]==sny[10] && rfid[12]==sny[11])

{

lcd_cmd(_LCD_CLEAR);

lcd_cmd(_LCD_CURSOR_OFF);

lcd_out(1,1,"RUWANDIKA.M.G.S");

lcd_out(2,1,"EN16078888");

for(c=0;c<13;)

{

UART1_write(sny[c]);

c++;

}

Delay_ms(2000);

asm {reset}
}

else if(rfid[1]==mnk[0] && rfid[2]==mnk[1] &&
rfid[3]==mnk[2] && rfid[4]==mnk[3] &&
 rfid[5]==mnk[4] && rfid[6]==mnk[5] &&
 rfid[7]==mnk[6] && rfid[8]==mnk[7] &&
```

```
rfid[9]==mnk[8] && rfid[10]==mnk[9] &&
 rfid[11]==mnk[10] && rfid[12]==mnk[11])

{

lcd_cmd(_LCD_CLEAR);

lcd_cmd(_LCD_CURSOR_OFF);

lcd_out(1,1,"VIDANAGE.M.P");

lcd_out(2,1,"EN16530690");

for(c=0;c<13;)

{

UART1_write(mnk[c]);

c++;

}

Delay_ms(2000);

asm {reset}

}

else

{

lcd_cmd(_LCD_CLEAR);

lcd_cmd(_LCD_CURSOR_OFF);

lcd_out(1,1,"Not identified");

lcd_out(2,1,rfid);

for(c=0;c<13;)

{

UART1_write(mnk[c]);

c++;

}

delay_ms(2000);

asm{reset}

      }

    }

  }

}
```

7. Design Aspects

The final part of the project is to make the cover for the system with provision for three ports. The three ports are : (i)to program the Arduino using the female USB B type, (ii)to program the PIC microcontroller, and (iii)DC male port. It's very easy for the user to feed the information about the student using the programming parts of the PIC microcontroller and the Arduino. The system has an ON/OFF button and a reset button. The reset button is used to reset the programming code. Also, we used 12.6v, 2500mAh rechargeable Lithium-Ion battery.

8. Results and Discussions

Initially, the id card details of the students are stored in the system. If the IID card details which is the tag number are uploaded to the system and read by the RFID, the microcontroller will send the information about the ID card to the Arduino. Then the LCD will display the student's name and the registration number. If we test an invalid ID card that is not saved in the system, then the PIC microcontroller will send the information about that to the Arduino and the LCD will display an error message.

9. Conclusion

The objective of this project is to make a portable attendance marking system to help in marking attendance in colleges, universities, and other educational institutions. There are mainly two attendance marking systems the RFID system and the Biometric system. The system we selected is the RFID system. The same project using our RFID can be extended to design a biometric system to mark the attendance. The aim of making this portable automated marking system is to reduce paper works, save time and money, and without errors.

Acknowledgment

The authors wish to DR. Lasantha Senevirathne and our supervisor DR. Chulantha Kulasekere . The authors also wish to thank their co-supervisor MR.

Manram Gnasekera for guiding them to do this project successfully.

Author contributions

Ashwin. M made the initial preparations for writing the research and doing the programming of the model. Neelawathura N.W.R.W and Devindan.S helped in correcting, polishing the draft, and programming the final model. Ruwandika.S did the final review. All authors read and approved the final manuscript.

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